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Parasites of Bluegill, *Lepomis macrochirus,* from Two Lakes and a Summary of Their Parasites from Michigan

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ABSTRACT: Seventy-five bluegill, *Lepomis macrochirus* (Rafinesque), collected in July 1996 from 2 small eutrophic lakes in central lower Michigan, were examined for parasites. Bluegill harbored 13 parasite taxa (5 Digenea, 1 Cestoda, 1 Acanthocephala, 3 Nematoda, 1 Copepoda, 1 Myxozoa, 1 Ciliophora). *Spinitectus micracanthus* was the most common gastrointestinal species, whereas *Posthodiplostomum* sp. was the most common species outside the digestive tract. The mean parasite species richness values ± SD in bluegill from the 2 lakes were 3.88 ± 1.42 and 4.80 ± 1.21. Quantitatively, the helminth fauna of bluegill was dominated by larval helminths represented by 7 taxa. The parasites of bluegill from Michigan waters are summarized.

KEY WORDS: parasites, bluegill, *Lepomis macrochirus,* Michigan.

The bluegill, *Lepomis macrochirus* (Centrarchidae), is a common species in the Great Lakes area and is important in Michigan as both a forage and game fish. Published studies are limited on the parasites of bluegill from Michigan and include Hughes (1928), Dobrovolny (1939), Esch (1971), Esch et al. (1976), Muzzall (1982, 1983), and Wilson et al. (1996). The few parasitological studies on bluegill in Michigan surprised us because the species is cultured in a large number of privately owned facilities and is commonly stocked in aquatic environments. The present study reports on parasites of bluegill from 2 lakes in central lower Michigan and summarizes the parasites of bluegill from Michigan waters.

Materials and Methods

Bluegill were collected by angling from 2 eutrophic lakes in Michigan in July 1996, put on ice, packaged, and frozen within 2 hr of collection. Five Lakes and North Porcupine Lake are approximately 1 and 2 mi NW of Gaylord, respectively, in Otsego County, Michigan. In addition to bluegill, both lakes have pumpkinseed, *Lepomis gibbosus,* and largemouth bass, *Micropterus salmoides.* Five Lakes has a surface area of approximately 25 acres and a mean depth of 1.8 m. North Porcupine Lake has a surface area of approximately 16 acres and a maximum depth of 5.5 m. Bluegill data include information on location, number examined, and total length with range in millimeters (followed by $\bar{x}$ ± SD): Five Lakes, n = 60, 98–201 (134 ± 22.3); North Porcupine Lake, n = 15, 88–157 (123 ± 14.7).

The entire fish was examined for parasites. Total length (millimeters) and sex of each fish were recorded at necropsy. After the position of the parasites was noted, they were removed, counted, and preserved in 70% alcohol. Prevalence is the percentage of fish infected, mean intensity is the mean number of parasites of each species per infected fish, and mean abundance is the mean number of parasites per examined fish. Voucher specimens have been deposited in the United States National Parasite Collection, Beltsville, Maryland 20705: *Crepidostomum cornutum* (87494), *Spinitectus micracanthus* (87495), *Leptorhynchoides thecatus* (87496), and *Ergasilus caeruleus* (87497).

Results

All bluegill from each lake were infected with 1 or more parasites. A total of 13 parasite taxa (12 from Five Lakes and 8 from North Porcupine Lake) infected bluegill (Table 1). *Clinostomum* sp., *Contracaecum* sp., *Ergasilus caeruleus* Wilson, 1911, *Myxobolus* sp., and *Trichodina* sp. were found in bluegill only from Five Lakes. *Diplostomum* sp. only infected bluegill from North Porcupine Lake. *Spinitectus micracanthus* Christian, 1972 was the most common gastrointestinal parasite of bluegill from both lakes. Of the helminth species found, only *Crepidostomum cornutum* (Osborn, 1903) Stafford, 1904, *S. micracanthus,* and *Leptorhynchoides thecatus* (Linton, 1891) Kostylew, 1924 were represented by gravid worms. The remaining 7 helminth taxa were represented by larval stages. Of the larval helminth taxa in bluegill, *Posthodiplostomum* sp. had the highest prevalence, mean intensity, and abundance from both lakes. Larval *Posthodiplostomum* sp. were densely clumped en masse in the liver of bluegill from North Porcupine Lake.

The mean abundance values of *Posthodiplostomum* sp. and *C. cornutum* were significantly higher in bluegill from North Porcupine Lake than from Five Lakes fish (Mann-Whitney test,

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Table 1. Prevalence (P), mean intensity (MI), maximum number of parasites (max.) and mean abundance (MA) of parasites found in *Lepomis macrochirus* from 2 lakes in central lower Michigan.

Species	Five Lakes (60)† P (%)	Five Lakes (60)† MI ± 1 SD (max.)	Five Lakes (60)† MA ± 1 SD	North Porcupine Lake (15)† P (%)	North Porcupine Lake (15)† MI ± 1 SD (max.)	North Porcupine Lake (15)† MA ± 1 SD	Site
Digenea							
Clinostomum sp.*	2	1	0.02 ± 0.13	—	—	—	Muscle
Diplostomum sp.*	—	—	—	13	2.0 ± 1.4 (3)	0.27 ± 0.80	Lens
Neascus sp.*	18	2.8 ± 3.3 (12)	0.52 ± 1.76	93	7.2 ± 7.4 (23)	6.73 ± 7.40	Muscle, branchiostegal rays, operculum
Posthodiplostomum sp.*	98	48.5 ± 34.1 (210)	47.0 ±34.9	100	812.1 ± 259.3 (1,341)	812.1 ± 259.3	Heart, gonads, liver, mesentery, spleen
Crepidostomum cornutum	13	1.9 ± 0.8 (3)	0.25 ± 0.70	53	9.1 ± 6.5 (21)	4.87 ± 6.60	Cecum, anterior intestine
Cestoda							
Proteocephalus sp.*	15	1.8 ± 1.2 (4)	0.27 ± 0.78	20	2.0 ± 1.7 (4)	0.40 ± 1.06	Liver
Nematoda							
Contracaecum sp.*	3	1	0.03 ± 0.18	—	—	—	Intestine
Spinitectus micracanthus	88	7.8 ± 6.8 (27)	6.90 ± 6.90	100	11.3 ± 6.9 (31)	11.3 ± 6.9	Intestine
Spiroxys sp.*	38	10.9 ± 21.1 (103)	4.18 ± 13.9	87	2.9 ± 2.8 (11)	2.53 ± 2.75	Encysted in/on stomach wall
Acanthocephala							
Leptorhynchoides thecatus	35	9.4 ± 13.6 (60)	3.28 ± 9.12	13	1	0.13 ± 0.35	Cecum, anterior intestine
Copepoda							
Ergasilus caeruleus	70	3.8 ± 3.3 (15)	2.67 ± 3.25	—	—	—	Gills
Myxozoa							
Myxobolus sp.	2	—	—	—	—	—	Mesentery
Ciliophora							
Trichodina sp.	3	—	—	—	—	—	Gills

* Larval or immature stages.
† (Number of bluegill examined.)

W = 1,830, $P < 0.0001$; Mann-Whitney test, W = 2,069, $P < 0.001$, respectively). Small numbers of bluegill infected with the other species precluded statistical analyses. The only significant correlation coefficient at Five Lakes was between *Posthodiplostomum* sp. intensity and host length (Spearman's Correlation = 0.632, $P < 0.01$). There were no significant correlations between parasite intensities and host length in North Porcupine Lake. There were no significant differences in the intensity or abundance (Mann-Whitney test, $P > 0.05$) and prevalence (chi-square analysis, $P > 0.05$) for the parasite species between female and male bluegill.

The mean parasite species richness values ± SD (with the range in brackets) for bluegill from Five Lakes (3.88 ± 1.42 [1–8]) and North Porcupine Lake (4.80 ± 1.21 [3–7]) were significantly different (Mann-Whitney *U*-test, $U = 2,107$, $P < 0.05$). A total of 3,942 individuals of 10 parasite taxa infecting bluegill from Five Lakes were counted. The parasite community composed of these species consisted of (number of individuals, percentage of community): *Posthodiplostomum* sp. (2,864, 73%); *S. micracanthus* (414, 10%); *Spiroxys* sp. (251, 6%); *L. thecatus* (187, 5%); *E. caeruleus* (160, 4%); and *Neascus* sp., *C. cornutum, Clinostomum* sp.,

Table 2. Summary of bluegill parasites and their prevalences from Michigan waters.

Parasite	Prevalence (%)	Reference
Monogenea		
Dactylogyrus sp.	2	Wilson et al. (1996)
Digenea		
Clinostomum sp.*	3	Wilson et al. (1996)
	2	Present study§
Crepidostomum cornutum	19	Esch (1971)
	13, 53	Present study§‖
Diplostomum sp.*	2	Wilson et al. (1996)
	13	Present study‖
Neascus sp.*	74	Wilson et al. (1996)
	18, 93	Present study§‖
Plagioporus lepomis	—†	Dobrovolny (1939)
*Posthodiplostomum minimum**	—†	Hughes (1928)
	95	Wilson et al. (1996)
Posthodiplostomum sp.	98, 100	Present study§‖
Cestoda		
*Proteocephalus ambloplitis**	91	Wilson et al. (1996)
Proteocephalus sp.*	—†	Esch (1971)
	15, 20	Present study§‖
Nematoda		
Capillaria sp.	1	Wilson et al. (1996)
Camallanus oxycephalus	5	Wilson et al. (1996)
Contracaecum sp.*	3	Present study§
Spinitectus micracanthus	50	Muzzall (1982)
	88, 100	Present study§‖
Spinitectus sp.	69	Esch (1971)
	5	Wilson et al. (1996)
Spiroxys sp.*	1	Wilson et al. (1996)
	38, 87	Present study§‖
Acanthocephala		
Leptorhynchoides thecatus	7–71‡	Esch et al. (1976)
	35, 13	Present study§‖
Leptorhynchoides sp.	24	Esch (1971)
Neoechinorhynchus cylindratus	9	Wilson et al. (1996)
Pomphorhynchus bulbocolli	32–93‡	Esch et al. (1976)
	20	Muzzall (1983)
Pomphorhynchus sp.	61	Esch (1971)
Copepoda		
Ergasilus caeruleus	70	Present study§
Myxozoa		
Myxobolus sp.	8	Wilson et al. (1996)
	2	Present study§
Ciliophora		
Trichodina sp.	3	Present study§

* Larval or immature stages.
† Present but prevalence not indicated.
‡ Ranges presented.
§ Five Lakes.
‖ North Porcupine Lake.

Proteocephalus sp., and *Contracaecum* sp., each less than 1%. In bluegill from North Porcupine Lake, *Posthodiplostomum* sp. comprised 97% of all parasites counted.

Discussion

Published reports on the parasites of bluegill from Michigan waters are Fife Lake (Hughes, 1928), Huron River (Dobrovolny, 1939), Gull Lake (Esch, 1971; Esch et al., 1976), Red Cedar River (Muzzall, 1982), St. Marys River (Muzzall, 1983), Holcomb Lake (Wilson et al., 1996), and Five Lakes and North Porcupine Lake (present study). Muzzall et al. (1995) also found 63 bluegill from Gull Lake negative for parasitic copepods.

The high mean intensity of *Posthodiplostomum* sp. in bluegill from North Porcupine Lake is not unusual. Colley and Olson (1963) and Mitchell et al. (1983) reported mean metacercariae intensities of 991 and 1,685, respectively. The latter authors found 5,333 metacercariae in 1 bluegill. The significant increase in *Posthodiplostomum* sp. in bluegill from Five Lakes probably occurred because metacercariae accumulate in larger, older fish.

Posthodiplostomum sp., quantitatively, was the dominant species in bluegill from both lakes. The mean abundance values of *Posthodiplostomum* sp. and *C. cornutum,* and parasites species richness in bluegill from North Porcupine Lake were significantly higher than in Five Lakes. *Diplostomum* sp., *Neascus* sp., *Proteocephalus* sp., and *S. micracanthus* were also more common in bluegill from North Porcupine Lake than from Five Lakes. This may be due to a larger number of intermediate hosts for these helminth species in North Porcupine Lake.

All digenean species found in the present study utilize snails as first intermediate hosts; all except *C. cornutum* use bluegill as second intermediate hosts and mature in piscivorous birds. *Crepidostomum cornutum* uses mayfly nymphs as second intermediate hosts, and *Spinitectus micracanthus* uses them as first intermediate hosts; both species mature in fish. *Leptorhynchoides thecatus* uses amphipods as intermediate hosts and matures in fish. Amphipods, *Hyallela azteca,* and mayfly nymphs often were found in our study in the stomachs of bluegill from both lakes. *Contracaecum* sp. may utilize various invertebrates as intermediate hosts. *Myxobolus* sp. probably utilizes tubificid oligochaetes as inter-

mediate hosts. *Ergasilus caeruleus* and *Trichodina* sp. have direct life cycles.

A total of 19 parasite genera (1 Monogenea, 6 Digenea, 1 Cestoda, 5 Nematoda, 3 Acanthocephala, 1 Copepoda, 1 Myxozoa, 1 Ciliophora) are reported from Michigan bluegill in 8 studies (Table 2). Of the 15 helminth genera, 7 are represented by larval or immature stages. Bluegill parasite data in Table 2 from Wilson et al. (1996) were combined for the open water and littoral zone. Dobrovolny (1939) experimentally infected bluegill with *Plagioporus lepomis,* but it is not clear if bluegill from the Huron River were naturally infected with this trematode. It is included, however, in Table 2. If a common parasite taxon is arbitrarily designated as one with a ≥25% prevalence in a study, 11 parasite taxa (*C. cornutum, Neascus* sp., *Posthodiplostomum* sp., *P. ambloplites, S. micracanthus, Spinitectus* sp., *Spiroxys* sp., *L. thecatus, P. bulbocolli, Pomphorhynchus* sp., and *E. caeruleus*) are common parasites of Michigan bluegill. Also, any given parasite taxon may exhibit variation in its occurrence as well as prevalence between environments. Jilek and Crites (1980) listed 16 parasite genera and 21 species in their summary of parasites of bluegill from Ohio waters. The following parasites have been found in bluegill from Michigan and Ohio: *C. cornutum, Neascus* sp., *Posthodiplostomum* sp., *P. ambloplites, L. thecatus, Neoechinorhynchus cylindratus, Camallanus oxycephalus, S. micracanthus, Spiroxys* sp., and *E. caeruleus.*

Hoffman (1967) listed over 100 parasite species infecting bluegill from North America, which far exceeds the total found in Michigan bluegill (Table 2). Interestingly, there are no published studies on the parasites of bluegill raised in culture conditions in Michigan. This indicates more parasitological studies need to be performed in Michigan on this important fish species.

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